Decision Navigation

Coping with 21st-Century Challenges in Tactical Decisionmaking

Lieutenant Colonel Dennis T. Gyllensporre
Swedish Army

AS HE TUTORED the young Alexander the Great, the Greek philosopher Aristotle challenged Alexander by asking what he would do in a given situation. Alexander said that it would depend on the circumstances. Aristotle described a hypothetical set of circumstances and repeated the question. Alexander replied, "I cannot tell until the circumstances arise."[1]

Clearly, Aristotle's young student, who would become the most successful battlefield commander or "battle captain" in history, understood that no plan could fully anticipate or capture the unique conditions and circumstances surrounding every decision during battle.[2] Alexander understood that decisionmaking must be intuitive and evolve as the battle unfolds.

Introducing Decision Navigation

Modern armies, like the U.S. Army, must transform tactical decisionmaking to meet 21st-century challenges. Currently, military planners approach tactical missions by deciding on a master blueprint for anticipated battles and engagements. They optimize detailed blueprints by fine-tuning and synchronizing activities to meet a set of conditions defined during planning. But we must recognize the validity of Helmuth von Moltke the Elder's statement that "no plan of operations survives the first collision with the main enemy body."[3]

The complex nature of warfare soon changes conditions defined during planning and renders the master blueprint obsolete. Much of the time and effort to design an optimized plan will have been wasted, and the commander and staff will have to develop and implement a new blueprint. In his article "Cultivating Intuitive Decisionmaking," former U.S. Marine Corps General Charles Krulak addresses the limitations of traditional analytical decisionmaking: "The greater the degree of situational certainty and awareness, the more effective analytical decisionmaking becomes. Unfortunately, the analytical model does not lend itself well to military applications once the enemy is engaged."[4]

The future battlefield environment will be more fluid, requiring commanders to cope with unprecedented complexity, uncertainty, and tempo. In addition, requirements for security will continue to increase. Coping with the changing battlefield environment requires improved methods and transformation of the underlying paradigm of decisionmaking. The examination here discusses the future battlefield environment and addresses implications for tactical organizations and the decisionmaking process from two perspectives: methods and underlying paradigms. By synthesizing the findings, we develop the concept of decision navigation (see figure).

Decision navigation describes a new way of decisionmaking. As soon as a combat unit receives its mission, it embarks on a voyage to a desired end state. Like Alexander the Great, the wise battle captain will navigate toward the destination by determining the position, direction of, and distance to the next decision point while always keeping the final destination firmly in mind. The journey will not follow a straight compass course. The commander will have to adjust course when he encounters obstacles and challenges.

Rather than developing a complete and detailed blueprint, the battle captain and his staff add details and sections to a basic blueprint as battles and engagements unfold. Decision navigation overcomes the limitations of traditional decisionmaking by allowing the commander and staff to make more timely, accurate, and intuitive decisions and take advantage of windows of opportunity. Decision navigation changes the commander's mindset and addresses the challenges that permeate tactical decisionmaking by applying the four following principles:

1. Develop only one course of action (COA).
2. Plan only the immediate phase.
3. Use your instincts as a decisionmaker.
4. Distribute uncertainty and complexity to subordinates.

The Future Battlefield Environment

The most significant changes in the battlefield environment for decisionmaking follow:

- Improvements in information technology are dramatically increasing the amount of information available to support the decision-making process.
- Improved technology and automation enable military planners to reduce the personnel strength of many functions, if needed. Consequently, units could be more dispersed and operate in extended battlefields. Operations in the Persian Gulf provide support for this trend. Operation Iraqi Freedom involved some 250,000 coalition troops; the corresponding number for Operation Desert Storm, conducted in a much more limited area, was 666,000.[5]
- Improvements in mobility, sensor range, and precision-engagement capabilities are creating a faster-paced and more lethal environment. Again, a comparison of operations in the Persian Gulf underscores this argument. Operation Desert Storm was over in 48 days; in Operation Iraqi Freedom, Baghdad fell in 21 days.[6]
- Asymmetrical threats and full-spectrum operations are increasing complexity.
- Real-time media coverage of operations is compressing response times for taking action. Embedded journalists during Operation Iraqi Freedom made it possible for the public to access commanders' concerns and thoughts during the decisionmaking process.
- The surgical-warfare image introduced during Operation Desert Storm cultivated values and

[Marine Corps General Charles Krulac said,] "The greater the degree of situational certainty and awareness, the more effective analytical decisionmaking becomes. Unfortunately, the analytical model does not lend itself well to military applications once the enemy is engaged."

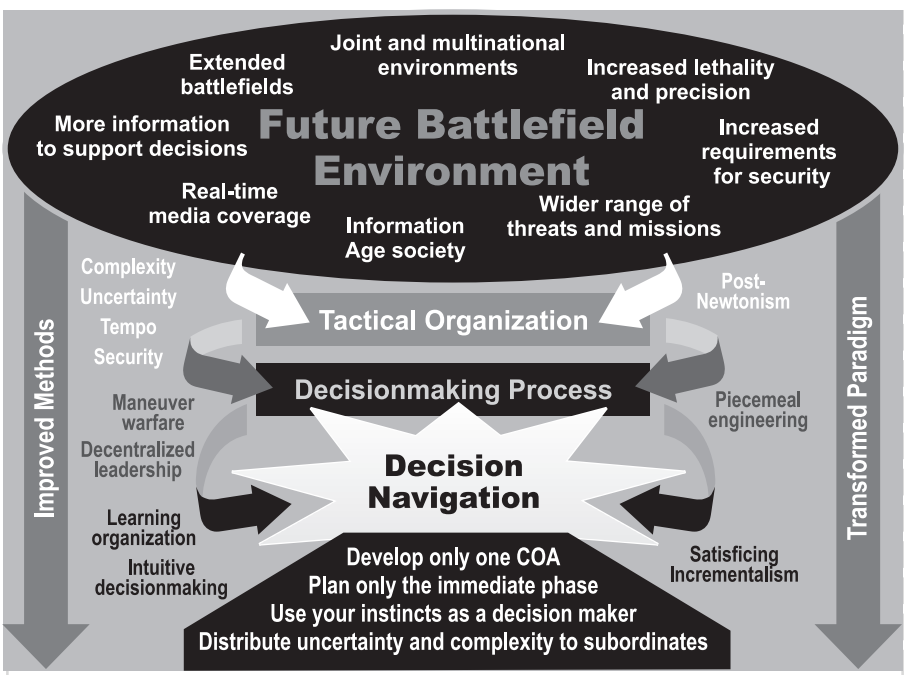

Figure. The conceptual model for transitioning to decision navigation.

nourished the belief that only minimal casualties are acceptable.

- The increased requirement to operate in joint and multinational environments reduces the commander's capability to fully anticipate the effects of decisions in all parts of the organization and calls for enhanced systems thinking.

This list identifies important challenges, but it does not tell us how to overcome them. The futurists Alvin Toffler and Heidi Toffler argue that the next generation of warfare will be based on values and perceptions developed in the Information Age society.[7] The transition that has begun will be the most profound of all military revolutions.[8] We recognize this change as a revolution in military affairs (RMA).

Like Alexander the Great, the wise battle captain will navigate toward the destination. . . . The journey will not follow a straight compass course. The commander will have to adjust course when he encounters obstacles and challenges. . . . Decision navigation overcomes the limitations of traditional decisionmaking by allowing the commander and staff to make more timely, accurate, and intuitive decisions and take advantage of windows of opportunity.

Although many authors credit Operation Desert Storm with defining the next generation of warfare, U.S. Navy Admiral Bill Owens, one of the first to note that an RMA is occurring, argues that, although some important technological elements were present on the battlefield, Operation Desert Storm was waged with Industrial Age methods.[9] Author Max Boot claims that operations in Afghanistan and Iraq showed the new American way of war.[10] The changes we anticipate as a new generation of warfare emerges are perhaps best understood by examining changes in underlying paradigms.

Moving beyond the Newtonian paradigm. By defining time and space as absolute and explaining the universe with a "majestic clockwork" metaphor, the British physicist and mathematician Sir Isaac Newton made people understand its orderly and predictable nature.[11] The Newtonian model became a foundation of the Enlightenment and the Scientific Revolution and embedded in Western philosophy as a paradigm.[12] Virtually all scientists and theorists have followed Newton's banner—some aware of the paradigm, some not.[13] Using the Newtonian model, planners identified optimal solutions by dividing problems into manageable subproblems and applying appropriate tools. They constructed a grand design to solve complex problems by putting all the subsolutions together.

Military professionals and others have written an immense number of articles arguing for improved decisionmaking. Joint Vision 2020 (JV 2020) recognizes the need for improved decisionmaking by outlining "decision superiority," making and implementing better decisions faster than the enemy can react.[14] However, JV 2020 does not explain how to make decisionmaking successful. A revolution in military affairs suggests a fundamental change in all aspects of warfare.[15] The transition to the Information Age is associated with a paradigm shift. Thus, the search for improved decisionmaking originates in a new post-Newtonian paradigm.

Albert Einstein's theory of relativity and Werner Heisenberg's uncertainty principle exposed flaws in Newton's paradigm early in the 20th century.[16] Today, we know that Newton's laws do not completely explain how nature behaves. Yet, in military decisionmaking and in other fields, we remain committed to Newton's majestic clockwork. German military strategist Carl von Clausewitz pioneered the post-Newton paradigm in military affairs by formulating the concept of friction, which tells us that we cannot foresee all circumstances: "Friction is the only concept that more or less corresponds to the factors that distinguish real war from war on paper."[17] Post-Newtonian thought recognizes uncertainty and complexity as natural in time-constrained environments and moves away from methods that aim for perfect knowledge. According to Heisenberg's uncertainty principle, the more precisely the position of an object is determined, the less precisely its momentum is known at that instant, and vice versa. This tells us that the commander must balance the need for precision in information with the need for its timeliness.

To understand the effect of the future battlefield environment on the tactical level, we must identify post-Newtonian paradigms that underpin future tactical decisionmaking and take a closer look at complexity, uncertainty, tempo, and security.

Tactical-Level Complexity, Uncertainty, Tempo, and Security

JV 2020 is permeated by the assumption that technology will provide sufficient information to reduce uncertainty and provide a clear enough understanding of the situation to makes precision engagements successful. But incidents like the accidental

US Army

U.S. soldiers on Leyte Island, 20 October 1944.

[Clausewitz said,] "Friction is the only concept that more or less corresponds to the factors that distinguish real war from war on paper." Post-Newtonian thought recognizes uncertainty and complexity as natural in time-constrained environments and moves away from methods that aim for perfect knowledge.

bombings of civilian convoys and the Chinese Embassy during NATO's 1999 air campaign in Kosovo indicate that there are flaws in this logic. As Clausewitz points out, "Many intelligence reports in war are contradictory; even more are false, and most are uncertain."[18]

Certainty can be viewed as the product of the amount of information available for decisionmaking and the complexity of the task. Increased complexity, all other things being equal, reduces the value of information available. Like the commercial relationship of supply and demand defining the market price at the equilibrium, there is an optimal point for certainty.[19]

Despite improvements in information technology and command systems, there is no evidence that today's modern armies are any more capable of dealing with information needs than their predecessors were a century ago.[20] The expectation of increased success in combat based on higher technological density in future command systems is sheer delusion.[21]

Uncertainty occurs on three cognitive levels.[22] The first is that of measurable data or information, the location of units and terrain features, for example. Uncertainty appears at a second level when inferences are drawn about data, such as conclusions regarding enemy intentions based on facts. At a third level, uncertainty occurs when planners project inferences into the future; for example, will the enemy attack X if we defend Y? Those who argue that technology reduces uncertainty focus on the first level, on information dominance and decision dominance, but they base their arguments on a simplified understanding of uncertainty.[23] Information is fuzzy; it can be partly right and partly wrong, and fractal. That is, no matter how high a resolution the system provides the decisionmaker, it can always provide some greater level of detail to explore.[24]

Successful decisionmakers navigate in a flood of information. In the first 30 hours of Operation Desert Storm, the command element of one Marine expeditionary force received 1.3 million electronic messages, not including facsimile, radio, or teletype messages.[25] When historians examine Operation Enduring Freedom and Operation Iraqi Freedom, they will most likely find that the information flow has been further amplified.

Increased information access increases complexity since, as writers John F. Schmitt and Gary A. Klein tell us, "Information is dramatically nonlinear; that

is, all pieces of information do not have nearly the same value or influence."[26]

New systems based on advanced technology and refined procedures increase specialization. The number of military occupational specialties in tactical units is steadily growing.[27] Complex and abstract systems increase the number of options for the commander, but also make the effect of decisions more difficult to anticipate. The Newtonian mindset attacks complexity by reductionist analysis; problems are broken down into manageable pieces. If the commander has less information than he needs, the unit might increase information processing and use multiple communications channels. But, this approach increases the size and complexity of the staff and is, therefore, inadequate.[28] Instead, simplifying the organization so that it operates with less information might increase command performance.

[The Newtonian style of decision-making] assumes the decisionmaker possesses perfect knowledge and perfect rationality; all the information he needs when he needs it; and that he makes his decisions without using any human values, prejudices, and emotions. Not surprisingly, decisionmakers seldom "comply" with the model.

When confronted with insufficient information, the commander might react by adjusting either the organization or the mission in order to operate successfully with less information.[29] He organizes units to work semi-independently and distributes uncertainty and decisions to subordinates.

Tempo is the rate of speed of battles and engagements. By controlling tempo, the commander can gain and sustain the initiative. Increased tempo calls for faster movement of troops, faster destruction of the enemy, and an increased capability to transition to subsequent phases or adopt branches or sequels.[30] From a decisionmaking perspective, the commander increases tempo by compressing the decisionmaking process or reducing the number of decisions.

To limit the number of decisions the commander and staff must make, subordinates must have the authority to make decisions. The organization should be as self-contained as possible, minimizing requirements for coordination. However, the leap in communications technology embodied in Force XXI links the highest and lowest levels of command, implying a risk that senior leaders might micromanage.[31] Skipping command levels increases the tempo of decisions, but it soon overloads the commander with uncertainty and complexity.

Security includes protection of friendly forces and mitigation of tactical risks. The public currently accepts or tolerates few casualties and tactical failures. The images of surgical warfare introduced during Operation Desert Storm and further enhanced during Operation Enduring Freedom and Operation Iraqi Freedom have nourished this view. Thus, the risks associated with, for example, soldiers not complying with the rules of engagement or incurring a significant number of heat causalities might have strategic ramifications. This could tempt a commander to instill tight control mechanisms, detailed guidance, and authorization requirements for some actions in order to limit subordinates' risks. After all, the commander has the ultimate responsibility. However, security does not necessarily imply tight control or centralized command.

Safety engineering and organizational research indicate that complex systems should be decentralized. Tightly coupled organizations—those in which different parts of the organization greatly depend on each other—are less prone to errors if they are centralized; loosely coupled organizations are best decentralized. Since tightly coupled complex systems are also prone to errors, complex organizations should be loosely coupled for the best risk management.[32]

Coping with these challenges puts a premium on decentralization and adaptive organizations, implying a need for maneuver warfare and the learning organization. Maneuver warfare and the learning organization are quite possibly already integral parts of a modern army, but there are no absolute definitions of these concepts. Their key characteristics need to be emphasized further, and this does not necessarily imply a need for only minor changes. The change in the underlying paradigm suggests a need for a transformation.

In narrowing the post-Newtonian paradigm, Sir Karl Popper, one of the greatest philosophers of science, provides a way forward. He did not believe in holism and Newton's grand design.[33] His theory for problem solving was *piecemeal engineering* based on

P1 → TS → EE → P2,

where P1 is the initial problem, TS the trial solution proposed, EE the process of error elimination applied to the trial solution, and P2 the resulting situation.[34] Rather than finding the optimal solution, Popper's theory calls for a continuous, iterative, reassess-readjust approach to finding an acceptable solution.

US Army

Colonel Carroll J. Armisted (*sixth from left*) conducts a hasty meeting with his 58th Infantry Regiment staff, Cherry Farm, France, 9 August 1918.

Despite improvements in information technology and command systems, there is no evidence that today's modern armies are any more capable of dealing with information needs than their predecessors were a century ago. The expectation of increased success in combat based on higher technological density in future command systems is sheer delusion.

In a comprehensive National Defense University study of command arrangements, the U.S. Army's command philosophy was found to be in the middle of the continuum from mission-specific to order-specific command philosophies.[35] The study concluded that a shift to a mission-specific command philosophy reduced the requirement of greater detail in and more frequent updates to the information necessary for decisionmaking. But this requires more proficient subordinates who possess a high degree of initiative.

Maneuver warfare stands out even more than before as the way ahead. Information Age technologies support centralized decisionmaking, but decentralized maneuver warfare "has its source at the deepest level of the Third Wave: post-Newtonian science."[36] In maneuver warfare, decisions are distributed, implying the distribution of complexity and uncertainty and fewer decisions facilitating tempo.

Identified challenges put a premium on adaptation. Learning organizations learn and respond to changes rapidly. In *The Fifth Discipline*, Peter Senge identifies five disciplines of a learning organization: personal mastery, mental models, building shared vision, team learning, and systems thinking.[37] Systems thinking demonstrates that every decision has effects in other parts of the organization, often in an unintended way.[38] In other words, we must recognize complexity.

Systems thinking also implies that limited understanding of how an organization works and limited understanding of the adversary's responses make detailed long-range plans of limited value. A successful leader in a learning organization evokes initiative from his subordinates and uses all of the intellectual horsepower that the organization can give him.

Decisionmaking in Transformation

At the tactical level, leaders and soldiers act incrementally, allowing for feedback and gradual adjustments. Leaders should undertake decisionmaking in the same way. Decisionmaking is an organizational process involving the commander and his staff as well as a cognitive act in the commander's mind.

Research in decisionmaking has followed a business administration path and a psychological path. In business administration, decisionmaking is viewed as an optimization problem; that is, it is a search for

Cassical decision theory does not reflect the conditions of real-life warfighting situations; that is, complexity, uncertainty, and tempo. Real-life problems tend to be ill-structured and goals are not well defined. Decisions tend to occur in a dynamic environment without complete or accurate information.

the best option in terms of economic gain or effectiveness. On the other hand, traditional psychological research aims to clarify an individual's motives for decisions.[39]

Modern approaches to the study of decisionmaking have shifted focus from the study of options to the study of action.[40] Many regard mathematician John von Neumann's *The Theory of Games and Economic Behavior* as being the classical analytical decisionmaking theory.[41] In Von Neumann's theory, the decisionmaker behaves in a strictly rational way to achieve the best results. This "ideal" method of decisionmaking, which is also a hallmark of Newtonian decisionmaking, has five steps:

1. Identify the problem.
2. Generate alternative solutions.
3. Evaluate and choose between alternatives.
4. Implement the chosen solution.
5. Maintain the solution by monitoring, reviewing, and appraising the situation.[42]

The model appears to be robust, especially if feedback loops are added. However, it assumes the decisionmaker possesses perfect knowledge and perfect rationality; all the information he needs when he needs it; and that he makes his decisions without using any human values, prejudices, and emotions.[43] Not surprisingly, decisionmakers seldom "comply" with the model.[44] The U.S. Army military decisionmaking process (MDMP) assumes that planners divide planning into discrete procedures terminating in an optimal plan.[45] However, there is no evidence that COA comparisons produce better concepts of operations.[46]

Authors Judith Orasanu and Terry Connolly argue that classical decision theory does not reflect the conditions of real-life warfighting situations; that is, complexity, uncertainty, and tempo.[47] Real-life problems tend to be ill-structured and goals are not well defined. Decisions tend to occur in a dynamic environment without complete or accurate information.

Decisionmaking is rarely a single event in a static environment during which the decisionmaker can deal with an isolated and well-defined problem.[48] Several scholars have attempted to explain the irrational behavior of decisionmakers.[49] David Wilson and Robert Rosenfeld argue that human efforts to make rational decisions rarely succeed.[50] Richard Cyert and James March noticed that in business administration, decisionmakers combine an economic goal (to maximize profit) with a bureaucratic one (to achieve a result that is satisfactory and sufficient).[51] This is "satisficing" decisionmaking; that is, an acceptable COA that meets objectives rather than a quest for the optimal solution. General George S. Patton, Jr., once said, "A good plan violently executed now is better than a perfect plan next week."[52]

In contrast to classical decision theories, the focus is not on choosing among alternatives but on finding an acceptable solution. In 1959, Charles E. Lindblom introduced "The Science of Muddling Through," arguing that complex problems cannot be solved by traditional analytical methods.[53] The traditional method, which is absolute, builds a complete plan from the beginning by identifying and managing all variables that can affect performance.[54] But there are too many variables and not enough money or time to allow a full examination of all of them and their interrelationships. Instead, a satisficing method should be used in which a COA that satisfies requirements but does not optimize them is outlined and the number of variables is limited. This method allows many small, incremental changes in a short time. Author Paul J. Harig says, "The most common and intuitively reasonable thing is to make an incremental decision based on what has happened up to that point."[55]

Cognitive aspects. From an individual's perspective, the act of decisionmaking will not change. There are three reasons for this. First, basic human characteristics will remain essentially unchanged. The human mind develops slowly. Studies shows that the average IQ gains three points every decade.[56] Second, the concerns a commander has prior to an important decision usually do not change. He will ask himself, "Is this the right time? Will we be successful?" General Dwight D. Eisenhower's anxiety before launching Operation Overlord during World War II was probably similar to General Norman Schwarzkopf's before initiating the ground war during Operation Desert Storm.[57] Future commanders will probably have the same concerns. Third, the cognitive decisionmaking process is not going to change.

Cognitive decisionmaking in dynamic, time-constrained environments begins with the receipt of new information. Commanders are constantly bombarded

U.S. Air Force personnel examine the remains of an Iraqi MIG-25 destroyed in its hardened shelter by a lazer-guided bomb, Jalibah Air Base, March 1991.

US Air Force

The public currently accepts or tolerates few casualties and tactical failures. The images of surgical warfare introduced during Operation Desert Storm and further enhanced during Operation Enduring Freedom and Operation Iraqi Freedom have nourished this view. Thus, the risks associated with, for example, soldiers not complying with the rules of engagement or incurring a significant number of heat causalities might have strategic ramifications.

with an enormous amount of information.[58] Depending on the commander's focus, cognitive capacity, and experience, specific sets of information will catch his attention. One of the commander's sensory memories encodes these informational elements and his short-term (or working) memory transfers and processes them.[59] When the new information interacts with the commander's knowledge; that is, his long-term memory, the commander creates new tactical knowledge and situational awareness.

The levels of uncertainty correspond to the three cognitive levels of awareness: perceiving the information, comprehending the current situation, and projecting a future status. Knowledge is stored in the long-term memory as schemata (objects, events, and situations), which the working memory combines into scripts to represent sequences of events or actions.[60] The more experienced the commander, the more scripts he possesses to apply to the situation.

As he processes new information, the commander incrementally develops situational awareness. He then uses his working memory to project a future situation based on a set of scripts (possible solutions). Once he finds a satisfying script, he has solved the problem. Cognitive decisionmaking is incremental, intuitive, and satisficing.

Recognition-primed decisionmaking. Recognition-primed decisionmaking is a decisionmaking method based on the satisficing concept. The decision process has three steps. At the situational-recognition phase, the decisionmaker recognizes and classifies the situation based on previous experiences. In the serial-option evaluation phase, the decisionmaker evaluates alternatives until he finds a satisfactory one. Alternative actions are queued according to typicality. The first action evaluated is the most typical. In the final mental-simulation phase, the decisionmaker mentally simulates actions and potential outcomes and implements or modifies them.[61] This decisionmaking method is similar to the cognitive process and is consistent with the paradigms discussed.

Intuition. Decisionmaking can be divided into two categories. The first is analytical decisionmaking, which is based on a logical method and a defined way to quantify results, such as the MDMP. The second is intuitive decisionmaking, which is based on the commander's instinct, such as recognition-primed decisionmaking. The more experienced the

In business administration, decisionmakers combine an economic goal (to maximize profit) with a bureaucratic one (to achieve a result that is satisfactory and sufficient). This is "satisficing" decision-making; that is, an acceptable COA that neets objectives rather than a quest for the optimal solution. . . . Patton once said, "A good plan violently executed now is better than a perfect plan next week."

commander, the more cognitive scripts he will be equipped with and the faster and more accurate his decisions will be. The commander's scripts drive his intuition. Successful commanders like Fredrick the Great and Napoleon recognized the importance of intuition as a key factor for successful leaders.[62] Writer Michael Handel argues that the "successful general is not the one who carefully implements his original plans . . . but rather the one who intuitively 'reads' the chaos on the battlefield well enough to take advantage of passing opportunities."[63] He adds: "Since it is impossible to weigh all of the relevant factors for even the simplest decision in war, it is the military leader's intuition (coup d'oeil) that must ultimately guide him in effective decisionmaking."[64]

The Vicksburg Campaign: Successful Decision Navigation

Major General Ulysses S. Grant's triumph in the Vicksburg Campaign (1862-1863) illustrates the key elements in decision navigation. The Union identified the Mississippi River as a Confederate center of gravity, an artery for commercial movements, and a mode for transporting troops and supplies. Consequently, the Confederates fortified decisive points along the river. In early 1862, the defense at Vicksburg, Mississippi, was the major obstacle to Union control of the Mississippi River. The railway hub in Jackson, Mississippi, east of Vicksburg increased the significance of the area.

After the Union Navy failed to seize Vicksburg, a land effort became necessary. Grant took command. His task was to clear the Mississippi River of the Confederate resistance that Lieutenant General John C. Pemberton's troops imposed. Planning the campaign involved myriad geographical factors, including the Mississippi Delta region, streams of various navigabilities, steep banks, and bluffs northeast of the city.[65] The complexity proved to be too great to capture in a grand design plan. From November 1862 to March 1863, Grant launched four unsuccessful attacks. Despite repeated failures and "navigation" among concepts, Grant kept the final destination in mind and was determined to accomplish the mission—to seize Vicksburg.

All Grant's attempts to attack from the south or the north were different in nature. Initially, he attacked in two columns, the objective being to engage and draw Confederate forces north of Vicksburg with Grant's column while Major General William Tecumseh Sherman's column pushed down the Mississippi River to seize the city. Confederate counterattacks on Union supply lines interrupted initial success. Grant immediately realized that the plan had failed and withdrew his column.[66] He distributed the problems of uncertainty and complexity by authorizing Sherman to inform him of any changed circumstances but *not* instructing him how to change his plan. Unfortunately, Grant's message did not reach Sherman in time, and the attack failed.[67]

By late January 1863, Grant had concentrated his 60,000-man army on the west bank of the river north of Vicksburg.[68] At this point, Grant did not conduct extensive planning (exploring and comparing courses of action) or plan an operation in detail (all the way to the end state). Instead, he followed his instincts. He focused on the immediate phase, ordering completion of a canal on the peninsula opposite Vicksburg, thus enabling an attack from the south. Despite substantial effort, the difficult terrain offered slow progress. Grant, demonstrating flexibility in leadership, changed focus and began exploring another way to get past Vicksburg on the west bank.[69]

Grant tasked Major General James B. McPherson's XVII Corps to clear a 200-mile river route from Lake Providence, Louisiana, 30 miles north of Vicksburg, but the swamps proved to be more challenging than anticipated. In early March, Grant abandoned this plan.[70] By then, he had already begun preparing for another attempt to seize Vicksburg by means of an amphibious attack launched from an area near the bluffs northeast of the city.[71]

Union Brigadier General Leonard F. Ross proceeded south as far as he could get. Grant was prepared to allocate most of his army on this axis of attack.[72] However, Pemberton's army was prepared to defeat the attack.[73] When Grant learned that Pemberton was sending reinforcements to counter the attack, Grant decided to send Sherman's corps along an alternative inland water route. Like Ross's mission, Sherman's was an effort to turn on the city's right flank.[74] However, the Confederates' prepared

Elements of the 2d Brigade, 3d Infantry Division during the drive on Baghdad, 31 March 2003.

US Army

Maneuver warfare stands out even more than before as the way ahead. Information Age technologies support centralized decisionmaking, but decentralized maneuver warfare "has its source at the deepest level of the Third Wave: post-Newtonian science." In maneuver warfare, decisions are distributed, implying the distribution of complexity and uncertainty.

defenses, and the difficult terrain forced Sherman to call off the advance. He also convinced Grant to withdraw Ross's attack.[75]

Difficult terrain and well-prepared defenses made all attempts unsuccessful and, despite all efforts, Grant's force made no progress.[76] But Grant and his staff proved to be a learning organization, capitalizing on failures by going "beyond military logic."[77] They planned to advance downstream past all fortifications, cross the river in boats, march upstream, and attack Vicksburg from the east.[78]

On 31 March, Grant's forces marched to the planned crossing of the Mississippi River at New Carthage, Mississippi, 30 miles southwest of Vicksburg. Again, unfavorable terrain conditions forced Grant to change the plan. His revised plan called for an assault landing at Grand Gulf, Mississippi, to lend support to Major General Nathaniel P. Banks's attack at Port Hudson, Louisiana, near Baton Rouge, and then, finally, to attack Vicksburg in a coordinated effort.[79] However, the gunboats were not able to neutralize the fortified Confederate position at Grand Gulf and Grant had to alter the plan once again.

Grant's modified plan was for troops to continue the advance 10 miles further south so the gunboats could land the four divisions unopposed on the east bank at Bruinsburg, Mississippi. At the time, the landing was the largest amphibious operation in U.S. history. Contrary to orders, Grant continued to advance eastward to Port Gibson, Mississippi, without the planned support from Banks whose force had again been delayed.[80]

The plan now outlined a march northeast to Edwards Station, Mississippi, which is between Vicksburg and Jackson. By controlling the railroad, Grant believed he would gain a marked advantage by cutting Pemberton's communications. The risks were obvious. The Union force would be located between Pemberton's force and potential Confederate reinforcements from Jackson and would have long, vulnerable lines of communications. Starting with the battle of Port Gibson (in a 17-day period of 200 miles of marches and 5 battles) Grant maneuvered his force within sight of the defenses on the eastern outskirts of the city.[81] This part of the campaign is often referred to as the blitzkrieg of the Vicksburg Campaign.[82] Grant, incrementally

National Archives

Grant and his staff proved to be a learning organization, capitalizing on failures by going "beyond military logic." Despite all hardships, Grant kept committed to the end state. He quickly identified when a plan became obsolete and made many changes as the campaign unfolded. Ready to exploit windows of opportunity, his focus was on the immediate phase.

adjusting his plans of advance based on the enemy's positions, including Pemberton's army east of Vicksburg and Confederate General Joseph E. Johnston's troops at Jackson, defeated the Confederate forces piecemeal. After more than a month of siege warfare, Pemberton surrendered to Grant on 4 July 1863.

Despite all hardships, Grant kept committed to the end state. He quickly identified when a plan became obsolete and made many changes as the campaign unfolded. Ready to exploit windows of opportunity (like Ross's success), his focus was on the immediate phase. Continuous adjustments and refinements of the plan made Grant a successful decision navigator. Once committed in an area where he did not have sufficient situation awareness (as during Sherman's first attack at Vicksburg), Grant distributed the problems of uncertainty and complexity by providing an intent and by empowering corps commanders to operate based on their own judgment. His bold move to continue without Banks's support and to attack to cut off Pemberton east of Vicksburg stands out as a crucial decision based on intuition.

Decision Navigation: The Way Ahead

The future battlefield environment will be highly complex, dynamic, and uncertain, and the requirements of force protection will increase. More than ever before, the leader is the focal point for conflicting interests. He must balance the need for fast—and accurate—decisions in a more demanding environment. The changing environment calls for a new paradigm for the next generation of warfare.

The new paradigm, moving beyond Newton's majestic clockwork metaphor, guides us to a new way of approaching decisionmaking. By accepting complexity, uncertainty, and tactical dynamics as natural ingredients in decisionmaking, the post-Newtonian paradigm shows that commanders must act incrementally and use intuition to develop satisficing decisions. The concept of decision navigation captures the new mindset. Tactical decisionmaking should use its four key principles to—

- Develop only one COA. Instead of developing several COAs and trying to find the optimal solution, the commander must speed up the process. He must focus on finding the one acceptable COA that meets operational requirements and is not complicated to execute.
- Plan only the immediate phase. The commander should focus planning and decisionmaking on the immediate phase. Complexity and uncertainty will make any long-range plans obsolete. However, the commander will need to outline and communicate several options (concepts, branches, and sequels) to create a shared understanding of how to accomplish the end state and to ensure there is sufficient readiness to execute subsequent phases.
- Capitalize on the commanders' instincts. Planners are exposed to more variables than they can deal with. Rather than having their time consumed by incomplete deliberations, commanders must narrow down the planning scope, using their instincts as decisionmakers to direct and focus the staff on

one COA, emphasizing the immediate phase. Research indicates that intuitive decisionmaking is more successful than analytical decisionmaking in time-constrained and dynamic situations. In addition, intuitive decisionmaking replicates the commander's cognitive process and is consistent with the post-Newtonian paradigms that will guide us in the design of the next generation of warfare.

▯ Distribute uncertainty and complexity to subordinates. The way to distribute uncertainty and complexity is simple. Commanders must delegate decisions to the lowest possible level. Distributed decisionmaking speeds up the decision cycle by limiting the number of commanders and staffs involved in the decision.

Knowledge is stored in the long-term memory as schemata (objects, events, and situations), which the working memory combines into scripts to represent sequences of events or actions. The more experienced the commander, the more scripts he possesses to apply to the situation.

Grant's triumph in the Vicksburg Campaign elevated him to the status of one of the greatest battle captains in history. His achievement provides guidance for future tactical decisionmaking. Clearly, one key to success in 21st-century tactical decisionmaking is in the application of decision navigation. ***MR***

NOTES

1. Bob De Wit and Ron Meyer, *Strategy: Process, Content, Context* (St. Paul, MN: West Publishing Company, 1994), 7-8.
2. John Keegan, *The Mask of Command* (New York: Penguin Books, 1988), 14.
3. Gunter Rothenberg, "Moltke, Schlieffen, and the Doctrine of Strategic Envelopment," in *Makers of Modern Strategy*, ed. Peter Paret (New Jersey: Princeton University Press, 1986), 299-300.
4. Charles Krulak, "Cultivating Intuitive Decisionmaking," *Marine Corps Gazette* 83, no. 6 (1999): 19.
5. Max Boot, "The New American Way of War," *Foreign Affairs* (July-August 2003): 43-44.
6. Ibid.
7. Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (New York: Little, Brown and Company, 1993), 31-32.
8. Ibid., 30-32.
9. Bill Owens, *Lifting the Fog of War* (New York: Farrar, Straus, and Giroux, 2000), 113.
10. Boot, 41-58.
11. Robert P. Pellegrini, *The Links Between Science and Philosophy and Military Theory: Understanding the Past: Implications for the Future* (Maxwell Air Force Base, AL: Air University Press, 1997), 12.
12. Ibid., 24.
13. Ibid., 12-24.
14. Henry F. Shelton, Chairman of the Joint Chiefs of Staff, *Joint Vision 2020* (Washington, DC: Government Printing Office [GPO], 2000), 8.
15. Toffler and Toffler, 32.
16. The more precisely the position is determined, the less precisely the momentum is known in this instant, and vice versa.
7. Carl von Clausewitz, *On War*, trans. and ed. Michael Howard and Peter Paret (New Jersey: Princeton University Press, 1976), 119.
8. Ibid., 117.
9. Martin van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), 265.
20. Ibid.
21. Ibid., 266.
22. John F. Schmitt and Gary A. Klein, "Fighting in the Fog: Dealing with Battlefield Uncertainty," *Marine Corps Gazette* 80, no. 10 (1996): 63-66.
23. Ibid.
24. Ibid., 65.
25. Ibid.
26. Ibid.
27. Van Creveld, 234.
28. Ibid., 269.
29. Ibid.
30. Partly based on U.S. Army Field Manual (FM) 100-15, *Corps Operations* (Washington, DC: GPO, 12 October 1996), 4-5.
31. Anthony J. Russo, "Leadership in the Information Age," *Military Review* (May-June 1999): 77.
32. Thomas J. Czerwinski, "Command and Control at the Crossroads," *Parameters* (Autumn 1996): 130.
33. Erasmus Universiteit (University), Rotterdam, on-line at <www.eur.nl/fw/claus/Pope/Popetekst_en.html> at the time this article was written.
34. Ibid; Blupete website, on-line at <www.blupete.com/Literature/Biographies/Philosophy/Popper.htm>, updated December 1999.
35. David S. Alberts and Richard E. Hayes, *Command Arrangements for Peace Operations* (Washington, DC: National Defense University, May 1995).
36. Czerwinski, 125.
37. Peter Senge, *The Fifth Discipline* (New York: Doubleday, 1990), 6-9.
38. Jack Gumbert, "Leadership in the Digitized Force," *Military Review* (January-February 1998): 14.
39. James E. Dougherty and Robert L. Pfaltzgraff, Jr., *Contending Theories of International Relations* (New York: Harper and Row Publishers, 1981), 468-69.
40. Berndt Brehmer, "Strategies in real-time dynamic decisionmaking," in *Insights in Decision Making: A Tribute to Hillel J. Einhhorn,* ed. Robin M. Hogarth (Chicago: University of Chicago Press, 1990), 26.
41. Lee Roy Beach and Raanan Lipshitz, "Why classical decision theory is an inappropriate standard for evaluating and aiding most decisionmaking," in *Decision Making in Action: Models and Methods*, eds. G. Klein and R. Calderwod (Norwood, NJ: Ablex Publishing Company, 1993), 21.
42. David Wilson and Robert Rosenfeld, *Managing Organizations* (United Kingdom: McGraw Hill Book Company), 149-50.
43. Ibid.
44. John F. Schmitt and Gary A. Klein, "How We Plan," *Marine Corps Gazette* 83, no. 10 (1999): 19; Beach and Lipshitz, 22.
45. Schmitt and Klein, 1999, 18.
46. Ibid., 20.
47. Judith Orasanu and Terry Connolly, "The Reinvention of Decision Making," in *Decision Making in Action: Models and Methods,* eds. Gary Klein, Judith Orasanu, Roberta Calderwood, and Caroline E. Zsambok (Norwood, NJ: Ablex Publishing Corporation, 1993), 7-10.
48. Ibid.
49. Beach and Lipshitz, 22.
50. Wilson and Rosenfeld, 149.
51. Richard Cyert and James March, *A Behavioral Theory of the Firm* (Copenhagen: Blackwell Publishing, 1992).
52. Wilson and Rosenfeld, 149.
53. George S. Patton, Jr., *War As I Knew It* (Boston, MA: Houghton Mifflin Company, 1947), 354.
54. Roger A. Golde, *Muddling Through: The Art of Properly Unbusinesslike Management* (New York: Amacon, 1976), 152-77; John Larkin, "The Science of Muddling Through Life," *PA Times* (May 1998): 5.
55. Russel L. Bergeman, "Are You Leading, Groping or Muddling (Or All of the Above)?" *Marine Corps Gazette* 83, no. 6 (1999): 42.
56. Paul T. Harig, "The Digital General: Reflections on Leadership in the Post-Information Age," *Parameters* (Autumn 1996): 135.
57. Ibid., 133.
58. Micheal W. Eyseneck and Mark T. Keane, *Cognitive Psychology* (United Kingdom: Psychology Press, 1995), 125.
59. Ibid., 125-29.
60. Rita L. Atkinson, Richard C. Atkinson, Barbara Fredrickson, and Ernest R. Hilgard, *Introduction to Psychology*, 10th ed. (Orlando, FL: Harcourt Brace Jovanovich Publishers, 1990), 315; Eyseneck and Keane, 263.
61. Raanan Lipshitz, "Converging Themes in the Study of Decision Making in Realistic Settings," in *Decision Making in Action: Models and Methods*, eds. Gary Klein et al. (Norwood, NJ: Ablex Publishing Company, 1993), 109.
62. Brian R. Reinwald, "Tactical Intuition," *Military Review* (September-October 2000): 80-81.
63. Michael Handel, *Masters of War: Sun Tzu, Clausewitz, and Jomini* (United Kingdom: Frank Cass, 1992), 120-21.
64. Ibid.
65. Michael B. Ballard, *The Campaign for Vicksburg: Civil War Series* (Fort Washington, PA: Eastern National, 1996), 5.
66. David Martin, *The Vicksburg Campaign, April 1862—July 1863* (Conshohocken, PA: Combined Books, 1990), 76.
67. Ibid. There were other reasons for the failure, but they are beyond the scope of this paper.
68. Martin, 83.
69. Ibid., 87.
70. Ibid., 88.
71. William C. Everhart, "Vicksburg and the Opening of the Mississippi River, 1862-63" in *C-600 Advance Book* (Fort Leavenworth, KS: U.S. Army Command and General Staff College, 1986), 374.
72. Martin, 89.
73. Ibid.
74. Everhart, 347.
75. Martin, 92.
76. Everhart, 347.
77. Bruce Catton, *Grant Moves South* (Boston, MA: Little, Brown and Company, 1960), 407.
78. Ibid.
79. Everhart, 348-9.
80. Ibid., 349.
81. Terrence Winschel, *Triumph and Defeat: The Vicksburg Campaign* (Mason City, IA: Savas Publishing Company, 1999), 9-10.
82. Ibid., 10.